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# THE EVOLUTION OF THE YACHT.

BY LEWIS HERRESHOFF.

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ABOUT ten years ago it became painfully evident to the American yachtsman that the style of craft then in general use was not the best form for speed or for desirable qualities of safety and reliability in manœuvring.

It is true that "the skimming-dish" had served and still serves an excellent purpose, for it fills local demands that no other style of vessel will answer, namely, in navigating shallow bays and inlets that may be found on our coast, from which the deeper yacht would be wholly barred.

It must also be said in favor of the old American type of yacht that its first cost was not more than half of the present lead-laden structure, and had the recently-adopted form been earlier in style, many would have been constrained to forego the pleasures and healthful recreation of yachting. It may be said in excuse of the general use of a class of vessel now thought undesirable (in addition to low cost) that the large deck and roomy cabin afforded gave a degree of comfort not found in later designs, and the remarkable infrequency of stormy weather and rough water on our entire coast during the yachting season allured our yachtsmen into the prolonged use of a style of vessel now known to be in essential qualities vastly inferior.

In England, yacht-designing has developed under wholly different conditions both as to the state of the surrounding water and the rules governing the classification of yachts in racing; there "beam" has been heavily taxed, while here no restriction has been placed on the width of our racing craft.

Stormy, rough seas wash the coast of the British Isles, and but a small expanse of really inland protected waters can be found that afford sufficient sailing or cruising ground.

The result, then, has been that the forms of yachts in England and America became as unlike as the conditions by which they are surrounded. In the following table the general dimensions of the extreme type of two English and two American yachts are compared ; and this also shows the difficulty of classification of English and American yachts for racing, and, indeed, of any comparison of desirable qualities :

	Designer.	Length over all.	Breadth.
		W. L.	Draught.
"Fannie".....	Richmond.....	72' 8"	23' 3"
	1874.	66' 7"	6' 0"
"Tara".....	J. Beavor-Webb....	66' 02"	11' 6"
			12' 0"
"Chittywee".....	J. Ash.....		4' 9"
	1882.	31' 5"	7' 0"
"Climax".....	Wheeler.....	26' 3"	13' 9"
		26' 2"	2' 6"

The performances of the English cutter "Madge" in our waters brought the first realization of the fact that we were on the wrong track. The cutter "Clara," also from England, repeated and emphasized the work of the "Madge," so that when the "Genesta" challenged for the famous Queen's cup, it appeared very probable that she might carry it home.

At this juncture Burgess appeared, and saved our reputation in yachting circles by the splendid work of his "Puritan"; and when her performance was repeated by his "Mayflower," the tide of new designing set in, and the success of the compromise model was assured ; and when the "Volunteer" defeated the "Thistle" it was recognized to be the most remarkable feat in the history of yachting.

In the new type of yacht, which, after our successes in the three great international contests, was a "compromise" between the American and English design, are combined what are believed to be the best in each—a measure of the extreme depth of the foreign craft and the modified beam of the native yacht.

In the three years following the success of the "Volunteer," the 30- and latterly the 40-foot class were thoroughly exploited in a struggle to beat the "Minerva," the finest type of English cutter that ever visited our shores. She proved well-nigh invincible, but at last Burgess with his "Gossoon" broke the spell, and the "Minerva" was finally beaten. The current year,

however, has witnessed the climax of yacht-designing in the magnificent class of 46-footers, which have awakened more general and deserved interest than any equal number of craft have ever aroused either at home or abroad.

The interest in this class has been intense from its very conception, and as keel after keel was laid down, adding a new member to the number, speculation began to be heard on all sides as to the probable chances of winning.

Of the eight yachts added to the 46-foot class during the current year, four were designed by Burgess, and one each by Paine, of Boston, Herreshoff, of Rhode Island, Winteringham, of Brooklyn, and Fife, of Scotland. For the most part they possess no marked difference in general proportions, and as a rule adhere to old lines, presenting but slight modifications of form from the most successful boats of recent construction.

The centreboard, always considered an essential adjunct in an American racing craft, has nearly disappeared in this class of racers; but one yacht can boast of the honor, if honor it be, of perpetuating the old custom. But it must be said in her praise that she stands either second or third in her class, and so far the vexed question of which is the better for speed, a keel or a centreboard, is unanswered.

The centreboard possesses the inalienable advantage, which it always will continue to hold, of materially lessening the draught of water of the vessel that employs it. Were the same proportional depth found in the keel 46-footers as in yachts of the 90-foot class, their draught of water would be so abnormally great that they would be practically shut out of most of our popular harbors. It is thought, then, wise practice to retain the use of the centreboard in yachts of the largest class. In making a just comparison between the keel and the centreboard, it must be admitted that the form of keel now in use on the deeper-draught boats is so disposed in relation to the body of the vessel as to closely resemble a centreboard; in fact, the keel yacht of the most approved design has in effect a centreboard fixed in position and forming a part of the construction of the hull.

Nearly all the yachts built recently for racing have shown on the part of their designers too great a tendency towards the employment of abnormal power; that is, too much lead below and too much canvas above. They nearly all come too closely to the

appellation of "brute"—a justly-applied term, and very properly one of reproach. That design is most commendable which renders a given duty with the employment of a minimum of power. Power is a costly factor; it means a greater prime cost and increased expense of maintenance, less durability in hull and rigging, and, in the main, a want of seaworthy qualities.

The Paine production is further removed from success than any one of her sisters, mostly by reason of too great power and consequent difficulties in construction of hull and adjustment of rigging. The yacht "*Gloriana*," designed and built by N. G. Herreshoff, of Bristol, R. I., has attracted from the earliest stages of her construction the deepest interest among yachting circles in America, and a share of English comment has been bestowed upon her. Native comment was divided, and foreign condemnatory in its character.

The cause of this unusual degree of interest is found in the fact that the "*Gloriana*" presents a decided departure in form from rival members of the 46-foot class, and, indeed, from any recorded previous construction (save the craft that her designer built and tested in the latter part of 1890), and, judging by her performances in New York in June and at Newport in August, it must be admitted that a new vein has been struck in naval architecture, and one that must have its effect on future designing.

In general proportions (save length on deck) and size of sail-spread, the "*Gloriana*" holds a middle position in her class; her draught of water also is about the same as that of her sisters, and in shape her sails are somewhat lower and wider than the others. Therefore the difference between her and the rest of her class can be explained only by the peculiar lines of her hull, to describe which will be here attempted; but to set forth in words what comes within the rightful domain of drawing is not easy, and the patience of the reader is solicited.

The most apparent difference in the form of the "*Gloriana*," when compared with other yachts, is her abnormal overhang at both bow and stern, her length over all being 70 feet, and on the water-line 45 feet 4 inches, giving her a very marked character and a singular profile. Her unusual overhang is an unavoidable consequence of the elongation of the body, or bilge, of the yacht, by which she gains ability to carry weight of lead ballast and press of sail. Were we to examine the model of a yacht of the usual type,

we would find that the body, or bilge, comes to a gradual end near the bow, which part of the model is made fine and sharp so as to insure an easy entrance, while the bilge at the forward part of the hull is quite full above the water. At the water-line the form of the vessel is a long, easy curve, so that, so long as the vessel remains in an upright position and does not pitch or bury the bows, her entrance is as easily performed as is possible; but when by press of sail the vessel careens, or when she is met by waves that make her bury the bows more or less deeply, then lines more or less abrupt and full are made to form a part of the entrance of the hull. Such contact with wave after wave soon diminishes essentially the speed of the yacht, often to a very serious degree.

This unavoidable diminution of speed through bringing full lines in contact with water during pitching is exactly what the form of the "*Gloriana*" is specially designed to counteract. If an observer were to examine her model, he would see that the body extends the entire length of the hull. From the extreme end of the overhang forward to the end of her finely tapered stern, there is no visible part above water that appears to correspond to the entrance of the common type of model; yet below water her lines are easy and sharp to a degree. Where the fulness of the bilge rises from the water near the bow and reaches forward to the extreme point of the overhang, the water-line seems full when compared to the entrance of other yachts, and the casual observer might reasonably think that such an entrance would move with difficulty through the water; but were he to watch closely the course of the displaced water when the vessel is under way, the mystery of her motion would be in a measure revealed.

It is true that the "*Gloriana*" makes a fuss around her bows when in motion, but it is of a wholly different character from that of other-formed vessels, the surface of the surrounding water seeming to roll over and disappear beneath the flare of her full-lined bow. Close examination also shows that the wave which is rolled outward is not a solid mass, nor is it raised considerably in height above the surface of the surrounding water; and since the resulting waves thrown off by her passage are few in number and small in size, the fact of easy movement is absolutely verified.

The usual form of bow resembles a sharp wedge with nearly

vertical sides that push the water aside in a large wave, while the "Gloriana's" bow is a more bluff wedge, having greatly inclined or flaring sides, and seems to dispose of the water displaced by the hull in a manner that makes but little disturbance of the surface.

As the "Gloriana" careens there is a slight lengthening of her immersed body, which aids in speed-giving, but her increase of length at such times is far less than is popularly supposed; it is not more than two or three feet in fairly smooth water, but in rough water, at intervals and for short periods, a greater length of her overhang at both bow and stern is utilized.

Pitching and diving with the "Gloriana" are performed far differently from the usual way. Owing to the buoyant nature of her overhang she does not dive into the waves as deeply as is usual, and, as has been before stated, she immerses, when diving and pitching, lines that are no fuller than those when progress in smooth water is made. The effect is that the surface of the water is far less disturbed by her passage, resulting in not only well-maintained higher speed, but in far drier decks than one would find on board yachts of the common form. During the race of the New York Yacht Club in June last the hatches of a schooner yacht having a water-line length double that of the "Gloriana" were washed off, while the decks of the "Gloriana" were wet only by spray: not once did she take over solid (green) water.

Another most valuable quality resulting from this newly-devised form is the ease and certainty that are given to the action of the rudder, which result is reached in a rather obscure but interesting manner. All yachtsmen familiar with the working of wide vessels of our old type recognize the difficulty of steering when the yacht is reaching or sailing free from the wind; at such times it is often necessary to have recourse to mechanical aid, in spite of which it is no unusual thing to lose control of the vessel temporarily.

In vessels of the usual form, when driven by fresh winds, the water is piled up against the lee bow, and owing to the bluff part of the bilge being wholly or partly immersed, the water it displaces forces the bow of the boat strongly to windward, giving the vessel a tendency to "luff," or turn toward the wind.

This "luffing" influence of the lee bow must be counteracted by the rudder, resulting in labor for the helmsman and loss of

speed from a double reason—the obstruction caused by the piling-up of the water of displacement under the lee bow, and the drag on the boat by the rudder, seeing that it must be carried at an abnormal angle to produce the required effect.

In the “*Gloriana*” there is no such influence under the lee bow, or at most a greatly lessened one, the water of displacement being disposed of in such a manner that it does not push the bow to windward; and at all points of sailing, running, reaching, or close windward work, she is guided with the utmost ease, answering quickly to the slightest motion of the tiller, even though her lee rail be “awash” when reaching with a wind of twenty-four miles an hour.

The increased deck room afforded by the long overhang is a factor of great value in the management of a vessel; the bowsprit need not be so long nor the boom project so far over the stern, thus giving more easy access to outlying portions of the sails in the operations of reefing, changing, or furling.

A very snug but practicable cruising rig for ocean work could be set within the length of the deck-line, omitting wholly the use of the bowsprit; an advantage of unquestionable value in stormy seas.

Beside the means of healthy recreation that yachting affords, it has a value in schooling youth in the manly art of navigation, and, greater than all, it furnishes means of experiment to test the real value of diverse models and rigs. The present perfection of the world’s naval and merchant marine is without doubt a direct outgrowth of experiences gained in the construction and handling of yachts.

The new departure as embodied in the “*Gloriana*” is of such a character that many desirable qualities are given to the vessel besides an evident increase of speed; the form of the “*Gloriana*” affords a greater degree of seaworthiness and increased capacity to carry cargo, to which may be added many lesser advantages.

Since it has become an established fact that human ends are better served by the use of steam in the navigation of the great oceans as well as lesser waters, the question follows naturally, Do the principles involved in the design of the “*Gloriana*” apply in any degree to the requirements of steamships for naval or merchant service on the ocean, or to a steamer intended for coastwise or inland-water use? It may be answered that all her special points



would be of value in steam navigation in greater or less degree, and their adoption would be easy, adding little to first cost and nothing to maintenance.

It is demonstrated beyond doubt that in most conditions of sea a vessel having the model of the "Gloriana" would attain given results of speed with less power, which means the consumption of less coal; and if even a slight saving could be effected it would be an immense advantage, for the amount of coal now used in the new transatlantic steamers that perform the trip in less than six days is appalling. In the best forms of marine engines now in practice a daily consumption of 40,000 pounds of coal for a development of 1,000 indicated horse-power is required, and when, as in case of the large ships now in use, 15,000 to 18,000 indicated horse-power is required, it can easily be seen how desirable even a slight saving of coal would be. The same conditions that attend the pitching and diving of a vessel of the "Gloriana" type would be of prime importance to a steamer navigating stormy seas; higher speed could be maintained under such conditions, and drier decks would also result, thus affording a greater degree of comfort and safety to the passengers and crew. Owing to the elongation of the body of the vessel, a greater carrying capacity could be realized, and even in a part of the overhang some classes of freight might be carried.

The overhang could be objectionable only when in dock, by requiring more space, but at sea there is plenty of room for any degree of prolongation, and by the placing of suitable bulkheads at or near the usual water-line, the overhang would serve as an element of safety in collision with ship or ice, by protecting the immersed part of the hull in a more effectual manner than can be possible with the common form of bow and arrangement of bulkheads.

A steamship designed with a "Gloriana" bow would not present so strong an objection to turning as the deep, wall-sided bows of a usually-modelled vessel. She would not pile up a wave on the side towards which the ship is turning; thus affording far better control of the ship by giving ability to turn in a smaller circle than is now common. Many accidents have been caused by the sluggish manner in which steamships answer their helms.

Let us hope that a steam vessel embodying the "Gloriana" principles will soon be built, so that the widest scope may be given

to any improved design calculated to benefit the condition of those who journey by sea or follow it as a vocation, and the functions of trade promoted by the use of safe, speedy ships with a maximum of carrying capacity.

The subject of yacht-designing cannot be complete without some tribute to the great designer, Burgess, whose recent untimely death is deeply regretted in every circle where yachting is known and naval architecture studied. He entered the field of designing at a period when the science was at the lowest ebb, when the failure of our old type of yachts began to be recognized; he gave it his study, thought, and skill, and left it on a well-established foundation with his brilliant successes in the defence of the Queen's cup and his splendid contributions to our yachting fleet, which together stand as a noble monument to his memory. He died at the zenith of his success, the pride of his countrymen and in fullest honor and confidence of all yachtsmen.

Too much cannot be done by those who are interested in the progress of designing as applied to yachts, as well as all marine constructions, to foster the spirit of international contests for friendly supremacy.

The modification of design for yachts on both sides of the Atlantic during the last decade has been amazing, and now that the best designers are working more in accord as to rules that govern the conduct and classification of yachts in races, it is to be hoped that even more rapid improvement will be made in the near future. The following table shows how nearly the general proportions of the newest yachts coincide, the examples being taken from well-known designers in England and America:

	Designer.	Length over all.	Breadth.
		W. L.	Draught.
"Oweene" .....	Burgess.....	62' 0"	13' 4"
	1891.	45' 9"	11' 3"
"Barbara" .....	Fife.....	63' 0"	13' 0"
	1891.	45' 9"	11' 8"
"Gloriana" .....	Herreshoff.....	70' 0"	13' 2"
	1891.	45' 4"	11' 2"
"Dragon" .....	Fife.....	45' 6"	10' 3"
	1889.		8' 4"

At the foundation of international contests lies the Queen's cup. To it a debt is owed by naval science of incalculable value. It has done more than scores of industrious designers

could do if they studied their own work only and compared it with similar types. And from this famous trophy we still look for further influence in designing, and in the development of thought and practice in the noble art of naval construction.

If the conditions that surround the tenure of this wonderful cup be not such as to promote friendly international rivalry, then let the duty and wish of every spirited American yachtsman be to modify the "deed of gift" so that soon our transatlantic friends may visit us again, and stir us to yet better and higher work.

Let us place the cup within easy range of all the world, and if it be lost we shall have gained untold times its value in incentive to still greater improvement. But as we stand to-day as regards the Queen's cup, we can easily afford to be lenient, with a yacht like the "Gloriana" to defend it, and a corps of designers well attuned to the "high pitch" of the requirements of yacht-designing.

LEWIS HERRÉSHOFF.